

CHEMICALS

Project Fact Sheet



DEMONSTRATION OF AN INNOVATIVE HOLLOW-FIBER MEMBRANE SYSTEM FOR COMPRESSED AIR DRYING

NEW TECHNOLOGY ALLOWS DRYING OF COMPRESSED AIR AT LOW POWER CONSUMPTION AND HIGH FLOW CAPACITY

Benefits

- Annual power savings of 0.8 trillion Btu by 2010
- No valves or moving parts, maintenance-free
- No electrical wiring or power needed
- No desiccant or dust
- Compact and lighter weight, flexibility in packaging into a system
- Purge control for additional power savings
- Rated for operation up to 150°F and 300 psig

Applications

The new air-drying membrane will impact all U.S. manufacturing industries that use compressed air.

Project Partners

NICE³ Program
Washington, DC

Texas Energy Coordination Council
Austin, TX

Air Products and Chemicals, Inc.
Allentown, PA

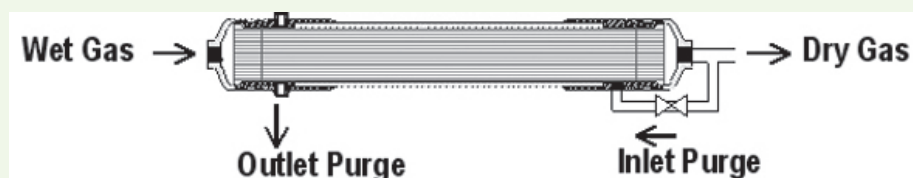
Danmar Industries
Houston, TX

A new hollow fiber membrane useful in dehydration of gases has been developed at Air Products and Chemicals, Inc. The membrane has water permeation coefficient and selectivity that are several-fold higher compared to present commercial membranes. It is suitable for drying of gases at pressures up to 300 psig and temperatures up to 150°F. Additionally, it has shown good resilience in a variety of challenge tests designed to simulate typical operating conditions and excursions. The unique properties of the new membrane enable favorable economics at high flow capacity, lower power consumption or purge loss, and wider operating pressure/temperature range versus the conventional desiccant technology. Other benefits to end users include those inherent in membrane systems to: no moving parts, maintenance-free, compact and light weight, modular, flexibility of packaging, no electrical wiring or power. A broad range of applications and markets in plant compressed air systems and point-of-use air dryers are amenable to the new technology.

In operation, the membrane modules are provided with an external purge (usually part of the dry gas stream) controlled via a flow restrictor; the purge carries the permeated water vapor. This configuration enables improved customization and process control. The compressed air dryer system will consist of an engineered package containing one or more modules, auxiliary equipment and controls.

Air Products will scale up membrane production and produce and test modules of commercial size at its manufacturing plant in St. Louis. This will be followed by the design, assembly, and operation of a commercial prototype system at Danmar Industries. Successful demonstration of this new technology will contribute towards energy efficiency in plant compressed air applications.

SCHEMATIC OF MEMBRANE DRYER MODULE



Compressed air flowing continuously through the bores of the polymeric hollow fibers is dried by selective permeation of water vapor. A fraction of the dry air is used as purge to carry away the permeated water vapor.



Project Description

Goal:

- Design, scale-up and conduct a field demonstration of a commercial-scale membrane system for compressed air drying based upon Air Products' innovative hollow fiber membrane technology
- Produce and test commercial-size modules of the new fiber at Air Products' manufacturing plant
- Design, fabricate, and test a membrane dryer system for drying of compressed air up to 1000 scfm inlet capacity.

Progress and Milestones

The following are the main tasks to be performed:

- Performance and design attributes from end users' perspectives will be combined with product engineering knowledge to derive an understanding of the trade-offs, and will be used to develop a product design that better meets end users' needs.
- Several module sizes are needed to effectively satisfy the flow capacity requirements of commercial customers. The modules produced will be used to determine the optimal configuration.
- A commercial membrane skid up to 1000 scfm total inlet capacity will be designed, fabricated, and tested.

Economics and Commercial Potential

Compressed air is widely used as a utility in many industrial and commercial applications. Its uses include lifting pneumatic devices, operating air cylinder devices an air motors, pressurization and atomization, and agitation of liquids. Compressed air is most often dried to avoid condensation or freezing in lines and to meet the needs of the process. Whereas refrigerant dryers are used at pressure dew points of 35° F and desiccant dryers are used at dew points of -40° F, membranes can be used to cover the range between 35° F and -40° F. The membrane can achieve the necessary degree of drying while requiring less purge air and hence achieving lower power consumption than a heatless desiccant dryer. Modular membrane dryer systems of large flow capacity are envisioned that can be used to produce pressure dew point between 35° F and -40° F at power consumption less than that of desiccants.

Commercial introduction of this technology is expected by 2003. Annual energy savings by 2010 would be 0.14 trillion Btu. By 2020 the savings would grow to 1.14 trillion Btu.



NICE³ – National Industrial Competitiveness through Energy, Environment, and Economics: An innovative, cost-sharing program to promote energy efficiency, clean production, and economic competitiveness in industry. This grant program provides funding to state and industry partnerships for projects that demonstrate advances in energy efficiency and clean production technologies. Awardees receive a one-time grant of up to \$525,000. Grants fund up to 50% of total project cost for up to 3 years.

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